

IT GRADUATES' FIRST YEAR OF EMPLOYMENT EXPERIENCES AND RECOMMENDATIONS FOR THE CURRICULUM DESIGN

Annelee Panday
Unisa

58562702@mylifeunisaac.onmicrosoft.com

Marthie Schoeman
Unisa

schoema@unisa.ac.za

ABSTRACT — Employment issues in South Africa (SA) are a significant problem. Ongoing discussions in SA revolve around the employability challenges facing South African graduates, particularly in the Information Technology (IT) sector. IT graduates' skill sets and employability status as well as the validity of the IT curriculum meeting industry needs have been questioned. A descriptive case study on graduates from an accredited, private higher education institution in SA using questionnaires and interviews was done to understand the experiences of employers, employed graduates and recruitment personnel upon employing the graduates, using qualitative analysis. This study investigated, determined and confirmed recommendations to adapt the institution's curriculum to improve the productivity of their IT graduates upon employment, which may be of value for other higher education institutions offering IT training.

Keywords: employability; IT curriculum design; IT graduates; skills gap; skill sets

INTRODUCTION

Employment issues pose a substantial problem for the country's economic growth (Brauns, 2013). Van Belle, Scholtz, Njenga, Serenko and Palvia (2019) found that the IT skills shortage is a higher priority in South Africa than in the developed world. Both employers and prospective employees (IT graduates) experience shortfalls and frustrations regarding the required skills that IT graduates should possess (Simon & Jackson, 2013). Pop and Barkhuizen (2010) highlight that IT graduates are not adequately prepared for the workplace. Similar frustrations have been voiced by other researchers studying the situation in South Africa (Simon & Jackson, 2013; Du Toit, Kraak, Favish & Fletcher, 2014; Taylor, 2016a). The lack of employability of the graduate labour market places strain on the economy on a global scale (Pop & Barkhuizen, 2013). Brauns (2013, p. 11) claims that, despite the rise in student numbers in tertiary education, a decline in employment is evident, adding that "employers want graduates who can do the job. It is up to colleges and students to make sure that they are ready to bridge this gap." The study seeks to investigate and determine industry recommendations aimed at enriching the higher education curriculum within the IT sector, so that IT graduates are more productive upon employment. It indicates the impact of a lack of industry experiences upon employing new graduates, as well as the key skills such graduates lack.

The main research question explored is, "What recommendations for improvements to the IT curriculum in South Africa could be extracted from an understanding of new graduates' first year of employment?" This led to four sub-questions:

1. What key skills do South African IT graduates lack upon employment?
2. What is the impact of graduates not being fully prepared to enter the workplace productively?
3. What measures does industry take when performance gaps are identified among employed IT graduates?
4. What would industry recommend to improve the higher education IT curriculum so that graduates are fully prepared to enter the workplace productively?

LITERATURE REVIEW

Over the past few years, South African IT graduates' readiness for employment has been debated. Key guiding themes in such debates involve a graduate's skill sets, employability, and the IT curriculum covered. Academics and students focus on developing technical skills, with scant attention paid to the interpersonal and additional skills graduates require when commencing employment. Employers require employees with problem-solving and critical-thinking skills, to feed the new economy. Universities are, however, not equipping students with the necessary

thinking skills: instead, they develop low-level thinking skills such as memorisation, hence they are unable to meet workplace demands (Kiener, Ahuna & Tinnesz, 2014). Graduates' skills do not align with the needs of industry, making the subject worthy of academic attention. The following sub-sections cover key guiding themes for graduate work readiness, focusing on curriculum design, skill sets and employability.

Curriculum design

A lack of academic preparedness, large classes and inadequate curriculum design are among the challenges facing South African higher education institutions (Jaffer, Ng'ambi & Czerniewicz, 2007). Support programmes to assist in eliminating these challenges are offered, but more resources and greater expertise could be beneficial. Work-integrated learning is a vital tool for preparing new entrants for the job market (Jackson, 2013). Despite this, South African universities' curricula are not evolving at the same fast-paced rate as the IT industry, with the result that ill-prepared students join the workforce (Moyo, 2013). Higher Education South Africa (HESA) highlights the importance of gathering information covering a graduate's study path, all the way to employment, as this could affect changes within institutions positively (Du Toit et al., 2014). Research into whether the Information Systems (IS) curriculum meets the needs of business, has opened up an avenue for investigation into the best ways of forging stronger bonds between industry and academia, to better prepare graduates for the workplace (Howard, 2017). Howard (2017) highlights that curricula do not hone key communication skills, including skills covering team proficiencies, consolidating and negotiation skills. This means that the academic community will have to look into ways of satisfying this particular industry need by putting measures in place to change, upskill and upgrade the curriculum constantly, to align with industry needs (Travis, 2017).

Skill sets

Skill sets are crucial for securing most types of employment. An in-depth scrutiny of a graduate's skill sets is performed prior to employment, to ascertain that the graduate would be the right fit for the position. Research has shown that there is a vital need for universities to cover more aspects related to soft skills (e.g. communication skills and professionalism) as well as for work-related experience (e.g. internships), to produce highly competent, flexible and employable individuals who are able to meet the ever-changing demands of the world of work (Andrews & Higson, 2008). This highlights the importance of hard, business-related knowledge (core competencies in the field) and the value of soft business-related skills, as well as work-related experience. Finding employment is a challenge for graduates from IT colleges and universities, mainly related to whether these graduates have attained crucial IT abilities and skill sets, including the wide-ranging general skills and profound technical skills which IT managers currently demand (Waldrop, 2017). Employers require candidates with amalgamations of behavioural skills/soft skills (e.g. communication skills such as writing skills, teamwork abilities, self-development) and technical skills/hard IT skills (e.g. designing, programming and troubleshooting skills) (Waldrop, 2017). To become more employable, graduates' much-needed skill sets should be varied, and should include soft skills, hard skills and critical thinking skills, as well as exposure to the latest technologies (Flores, Matkin, Burbach, Courtney & Harding, 2012; Mohlala, Goldman & Goosen, 2012; Simon & Jackson, 2013; Taylor, 2016a). Thus, various skill sets play a pivotal role in developing graduates for the workplace (Amiruddin, Ngadiman, Kadir & Saidy 2016; Taylor, 2016b).

Employability

Employability is emphasised increasingly in the higher education domain, as it is the role of such entities to produce graduates who can thrive in the 21st century workspace (Shivoro, Shalyefu & Kadhila, 2018). Ensuring that key skill sets are incorporated into the developmental stage of a student's study life cycle will lead to better and more employable graduates entering the workspace. Reports on the CC2020 global project – which engages with the upkeep of computing curricula on a global platform, in collaboration with the Association for Computing Machinery (ACM) and the Institute of Electrical and Electronics Engineers (IEEE) – serve to bolster graduates' employability (Impagliazzo & Pears, 2018). The CC2020 project group, which is tasked

with identifying new curriculum guidelines, has found that IT competencies within curricula (for computing across all IT arenas) usually involve three key aspects: knowledge, skills and disposition. "Knowledge" refers to core concepts of the discipline of study, while "skills" covers the ability to develop and refine one's abilities via hands-on practice and activity. "Disposition" refers to the graduate's attitude, behaviour, social skill and emotional capabilities. Building these competencies into the curriculum will establish stronger guiding principles on how to develop graduates' skills for the workplace.

Higher education needs to align the curriculum so that it heightens graduates' employability through industry collaboration, to allow students to become productive members of the workforce, post-graduation. Curriculum design, skill sets and employability aspects all need to be addressed.

RESEARCH CONTEXT

The research was conducted at a South African accredited private higher education institution in the department of IT of the Applied Science faculty. The department offers two modes of study: the traditional face-to-face (lecturing), contact mode called Lecture-based Learning (LBL) and the self-directed, self-study contact learning mode called the Mastery Learning Methodology (MLM) in which most of the study material is covered via self-study whilst on campus. The modules must be completed consecutively within the specified time frame and require a 60% pass mark. The MLM mode of study offers only Higher Certificate qualifications at National Qualifications Framework (NQF) level 5. This study considered only graduates who follow the MLM mode of study.

METHODOLOGY

A descriptive case study (qualitative research) was done to determine industry's experience with newly MLM-graduate employees to obtain guidelines for improving the curriculum. Questionnaires and interviews collected data from three IT companies employing MLM-mode graduates. Three different questionnaires were designed for the three different types of participants: line managers of employed graduates, the employed graduates themselves, and recruitment personnel. Pre-testing was conducted in the form of a pilot study.

The questionnaires focused on the role of a graduate's results and qualification in becoming productive, and the time taken to become productive. Key skills lacked upon employment and the effect thereof on the company were explored as well as the measures put into place to counter these. In addition, recommendations for improving the curriculum were sought.

Participants were assured of anonymity to provide them with some level of comfort about sharing their experiences and feedback. The questionnaires were distributed via Google Forms, and the responses were captured automatically on a spreadsheet. Each participant's questionnaire feedback was used to create semi-structured interview questions tailored to the participant. Semi-structured face-to-face interviews were conducted with the line managers of the employed graduates and the graduates, to further probe the feedback they provided in their completed questionnaires, and to explore their experiences. Recruiting personnel shared their experiences via a questionnaire. Table 1 depicts the 12 participants' demographics.

Table 1. Participants' demographics

Participant	Duration of employment	Age range	Gender
Employed Graduate 1	2 years 4 months	21–24	Male
Employed Graduate 2	1 year 8 months	21–23	Male
Employed Graduate 3	3 years 6 months	22–25	Male
Employed Graduate 4	1 year 10 months	21–23	Female
Line manager – Company 1	12 years	35–40	Male
Line manager – Company 2	18 years	40–45	Male
Line manager – Company 3	15 years	40–45	Male
Line manager – Company 4	20 years	45–50	Male
Recruitment personnel 1	10 years	25–30	Male
Recruitment personnel 2	8 years	25–30	Female

Recruitment personnel 3	12 years	30–35	Male
Recruitment personnel 4	15 years	30–35	Male

Recorded interviews were transcribed for ease of analysis. Triangulation was used to determine whether the same or similar data sets and patterns had emerged from multiple sources (the questionnaires and interviews from all participants) by means of manual colour coding data from questionnaires and interviews.

FINDINGS

The findings from the four sub-questions are presented below and used to answer the main research question:

Sub-question 1: What key skills do South African IT graduates lack upon employment?

Soft skills in the form of communication and professional skills have been identified as among the key skills graduates lack upon employment. Feedback from participants indicated that it is difficult for employed graduates to express themselves when faced with problems and to communicate with different levels of management (*"common problem has been failure to accurately verbalise... they don't want to feel that they are silly or stupid or almost like they think they are going to give away that they don't really belong here, if they ask something fundamental"*). In addition, the ability to maintain professionalism within the work environment also appeared to be lacking (*"a professional, presentable individual, that's something unfortunately we don't see a lot of"*). The lack of professionalism includes skills such as time management (*"there is no time management, we have to start from scratch"*), team work (*"... someone that is engaged in a team is way more productive than someone a little bit more withdrawn and not willing to join the team"*), people skills, communication skills, accepting responsibility (*"giving a task and then just running with it"*), adaptability (*"be flexible, you will always learn new things"*), and conflict management (*"a little bit of immaturity when it comes to conflict management"*). These findings correlate with literature indicating the skill sets required for employment (Andrews et al., 2008).

A lack of practical/technical skills in IT areas of software and hardware such as debugging, working on existing systems, the proper use of version control tools, web services and servers (*"all the peripheral tools from a software development environment, things like code versioning ... they are not familiar with the tools, the purpose of having those tools"; "...minimum practical experience ... they were not comfortable in any technical configuration"*) have also been identified. These concur with the technical skills that IT managers demand, as pointed out by Waldrop (2017).

The ability to problem-solve has been pointed out as a deficiency (*"taking a problem and making it your own, coming back with one, two or three possible solutions ... without a lot of management intervention"; "...go look, is there something out there that can be reused?"*). In addition, graduates demonstrated a lack of core subject knowledge such as multithreading in application development, web development, networking and server concepts (*"what I have done at varsity was 10% of what I actually needed to do at work ... now what is a web service, they never taught me something like that at varsity"; "I'm worried that the guys do not do enough design, systems design"*).

Sub-question 2: What is the impact of graduates not being fully prepared to enter the workplace productively?

Inadequately prepared graduates have a financial impact on a department without realising it (all graduates claimed that their initial lack of productivity did not impact the company). Line managers offer extra courses or identify specific certifications to upskill unprepared graduates. The employer bears the cost of the courses or certifications as well as the loss of revenue due to the graduate not being productive. Most participants believed that their higher education results did not affect the time taken to become productive. One participant offered a different view, explaining that the knowledge gained during his studies assisted him in becoming productive quickly (*"the skills that I learnt in my studies, that theory and the knowledge that I gained from that is the same knowledge that I needed to do my job, it was basically applying that knowledge in the working environment"*).

Sub-question 3: What measures does industry take when performance gaps are identified among employed IT graduates?

Line managers provided coaching and mentorship as well as training in specialised IT areas with Java, Microsoft and Comptia certifications. Employed graduates are also subjected to performance management on a weekly basis. Impagliazzo et al. (2018) indicate the importance of ensuring IT competencies for graduates.

Sub-question 4: What would industry recommend to improve the higher education IT curriculum so that graduates are fully prepared to enter the workplace productively?

Industry recommends paying more attention to incorporating soft skills in the curriculum as well as incorporating extensive work-related practical and technical aspects (*"...include a lot of practicals, you know, real-life situations ... IT certifications are now big because they prepare someone for the real-time, real-world environment in a way, you understand what you're supposed to do and you actually practise what you're supposed to be doing, as opposed to a lot of theory"*). These can be achieved by collaborating with industry to expose graduates to the latest tools and concepts used in industry, and correlates with Howard's (2017) findings.

Main research question: What recommendations for improvements to the IT curriculum in South Africa could be extracted from an understanding of new graduates' first year of employment?

The findings and recommendations were derived from the questionnaires and interviews with the participants. It was found that strengthening graduates' skill sets by covering more soft skills, hard skills, critical-thinking skills and trending technologies would prepare the graduates better for employment. Amendments are recommended to curriculum design to include more exposure to industry-related practical work with greater exposure to industry environments by maintaining industry and academia liaisons. Greater exposure to the latest tools used in the industry would assist graduates during their first year of employment and would enhance their employability status by including IT-related certifications in specialised areas (e.g. alignment with and/or the addition of international certifications).

Both the findings and recommendations directly relate to and fed into the themes covered in the literature review, namely curriculum design, skill sets and employability. The findings further relate to the globally aligned views of the ACM and the IEEE, whose objectives are to ensure skills development and a commitment to ongoing education (IEEE, 2018). When comparing these findings to those of the ACM and IEEE's CC2020 project, there is a direct link with the three key aspects of the CC2020 project, namely knowledge, skills and disposition. Skills relate to incorporating more hands-on practice, which ties into the finding that more practical/technical work-related activities are needed. Knowledge relates to the need to ensure that core concepts of the discipline are covered and strengthened through exposure to the latest industry-aligned tools and concepts. Lastly, disposition entails attitudes and behaviour, which link directly to this study's findings regarding the soft skills graduates need to hone.

RECOMMENDATIONS

Based on the feedback from the participants and the literature review, recommendations for updating the institution's IT curriculum can be made by focusing on three areas, namely, strengthening the graduates' skill sets, amending the curriculum design and covering employability aspects. Soft skills and hard skills can be developed by incorporating the communication and professional skills as well as industry-related practical work in the curriculum. Collaboration between academia and industry is recommended to achieve industry-related practical work. This collaboration would also lead to the graduates being exposed to trending technologies. Incorporating the development of critical thinking skills is also necessary to strengthen graduates' problem-solving skills as required by industry. Developing the social skills associated with the attitude, behaviour and emotional abilities to allow graduates to be successful in the workplace, as recommended by the CC2020 project, will enhance employability.

Amending the curriculum design to incorporate the key skills required can be aided by academia-industry collaboration to afford greater exposure to industry-linked environments that would ensure hands-on activities and practices, which is also recommended by the global CC2020 project. Finally, employability recommendations also indicate the need to include IT-related certifications in specialised areas that align to international certifications, incorporating core discipline-related concepts.

CONCLUSION

This case study investigated the experiences of newly graduated IT employees and their managers to obtain industry's recommendations to improve the undergraduate IT curriculum of a private higher education institution in South Africa, with the aim of better preparing graduates for their first year of employment. The findings show the financial impact unprepared graduates have on industry, and that with better preparation, new graduates could be more productive within their first year of employment. Vital skills that the graduates lacked entail various components of both soft and industry-related practical skills. As discussed in the recommendations, enhancing the IT curriculum would equip new graduates with industry-required attributes that would assist in providing better prepared graduates for industry.

The data collected reflected noteworthy trends, confirmed by the literature, that offer valuable preliminary points for more informative studies on the topic of curriculum enhancements in higher education in relation to the IT sector.

REFERENCES

- Amiruddin, M.H., Ngadiman, N., Kadir, R.A. & Saidy, S. (2016). Review of soft skills among trainers from Advanced Technology Training Center (ADTEC), *Journal of Technical Education and Training*, 8(1), 14–24.
- Andrews, J. & Higson, H. (2008) Graduate employability, “soft skills” versus “hard” business knowledge: A European study, *Higher Education in Europe*, 33(4), 411–422.
- Brauns, M. (2013). Employability of graduates through work-integrated Learning (WIL). (Working paper).
- Du Toit, J., Kraak, A., Favish, J., & Fletcher, L. (2014). From study to work: Methodological challenges of a graduate destination survey in the Western Cape, South Africa, *Assessment and Evaluation in Higher Education*, 39(7), 853–864.
- Flores, K.L., Matkin, G.S., Burbach, M.E., Courtney, E. & Harding, H. (2012). Deficient critical thinking skills among college graduates: Implications for leadership, *Educational Philosophy and Theory*, 44(2), 212–230.
- Howard, R.D. (2017). Does the Information Systems Curriculum Meet Business Needs: Case Study of a Southeastern College – PhD thesis, Capella University.
- IEEE. (2018). Retrieved from <https://www.ieee.org/education/index.html>.
- Impagliazzo, J. & Pears, A.N. (2018). The CC2020 Project – Computing curricula guidelines for the 2020s, 2018 IEEE Global Engineering Education Conference (EDUCON), 2021–2024.
- Jackson, D. (2013). The contribution of work-integrated learning to undergraduate employability skill outcomes, *Asia-Pacific Journal of Cooperative Education*, 14(2), 99–115.
- Jaffer, S., Ng'ambi, D. & Czerniewicz, L. (2007). The role of ICTs in higher education in South Africa: One strategy for addressing teaching and learning challenges, *International Journal of Education and Development Using Information and Communication Technology*, 3(4), 131–142.
- Kiener, M., Ahuna, K.H. & Tinnesz, C.G. (2014). Documenting critical thinking in a Capstone course: Moving students toward a professional disposition, *Educational Action Research*, 22(1), 109–121.
- Mohlala, J., Goldman, G.A. & Goosen, X. (2012). Employee retention within the information technology division of a South African bank, *SA Journal of Human Resource Management*, 10(2), 1–22.
- Moyo, A. (2013). IT graduates ill-prepared for job market, ITWeb's business editor. Retrieved from http://www.itweb.co.za/index.php?option=com_content&view=article&id=68538
- Pop, C. & Barkhuizen, N. (2010). The relationship between skills training and retention of graduate interns in a South African information, communication and technology company. *Literacy Information and Computer Education Journal*, 1(2), 113–122.
- Shivoro, R.S., Shalyefu, R.K. & Kadhila, N. (2018). Perspectives on graduate employability attributes for Management Sciences graduates, *South African Journal of Higher Education*, 32(1), 216–232.
- Simon, D., & Jackson, K. (2013). A closer look at information systems graduate preparation and job needs: Implications for higher education curriculum enhancements. *World Journal of Education*, 3(3), 52–62.

Taylor, E. (2016a). Development of soft skills in accordance with governmental critical outcomes: An IT-programme at a university in South Africa, 7th Annual International Conference on Computer Science Education: Innovation & Technology, 38–47.

Taylor, E. (2016b). Investigating the perception of stakeholders on soft skills development of students: Evidence from South Africa, *Interdisciplinary Journal of e-Skills and Lifelong Learning*, 12(1), 1–18.

Travis, T.A. (2017). From the classroom to the boardroom: The impact of information literacy instruction on workplace research skills, *Education Libraries*, 34(2), 19–31.

Van Belle, J.P., Scholtz, B., Njenga, K., Serenko, A. & Palvia, P. (2019). Top IT Issues for Employers of South African Graduates. In: Kabanda S., Suleman H. & Gruner S. (eds) ICT Education. SACLA 2018. *Communications in Computer and Information Science*, vol 963. Springer, Cham

Waldrop, G.L. (2017). IT Employer and Graduate Assessments Regarding Preparedness in Skills of IT College Graduates Offered Employment – PhD thesis, Cappella University.